6 SEWAGE IMPACT ASSESSMENT

6.1 Design Flows and Loads

The design flows and loads were based on the latest planning data of the proposed Cyber Port Development and the existing developments in Baguio Villas and Kong Sin Wan Village. The development data was broken down into the housing type with allowance made for service apartments and hotels. The working population in the catchment area was also taken into account. The population figures were derived from the proposed Development Schedule. The design flows and loads were then estimated by applying the flow and load factors recommended in the DSD Sewerage Manual (see Tables 6.1 and 6.2 below). For the purpose of estimating the design flows for the preliminary treatment works and SSDS connection facilities, a more conservative factor of 290 l/h/d for commercial activities using all employed population has been adopted. This approach is in line with the SSDS Stage III/IV PPFS project to allow for possible increased flows in long-term future. However, for the temporary package plant and the CEPT plant, a factor of 60 l/h/d is adopted for the employed population other than those in the Cyber Mall and a factor of 290 l/h/d for projected employees at the Cyber Mall to allow for commercial activities. This approach is considered more practical for the package and CEPT plants because of their limited design horizon and is in line with the recommendations in the Sewerage Manual.. An emergency overflow system should be provided downstream of the preliminary treatment works. The exact design flows will be further considered at the detailed design stage

The peaking factor of 2.5 has been adopted for the new development and 3.5 for the existing Baguio Villa and Kong Sin Wan Village.

Table 6.1 Design Flows

	Average Flow	Peak Flow
Preliminary Treatment Works	10,013 m^3/d	0.32 m^3/s
CEPT	7,253 m^3/d	0.24 m^3/s

Table 6.2 Raw Sewage Concentration and Loading

Parameter	Concentration
BOD	250 mg/l
COD	420 mg/l
SS	250 mg/l
TKN	40 mg/l
NH3-N	25 mg/l
E coli	2.00E+07 counts/100ml

Data sheets containing the detailed breakdown of the flows and loads are contained in Appendix 6.1.

6.2 Effluent Quality Standards

The Final Report of the Strategic Sewage Disposal Scheme Stage 1 Pilot Plant Study on Chemical Dosing and Disinfection estimated that CEPT could achieve SS removal efficiency of 85% and BOD removal efficiency of 50%. However, to allow uncertainties at this early stage of this Scheme, it is recommended that the CEPT removal efficiency of the Telegraph Bay STW is approximately 50% for SS and 50% for BOD. In addition, it is expected that the CEPT process would achieve 50% E. coli removal and the disinfection process would have a removal efficiency of approximately 3 log kill. The estimated effluent quality from the proposed STW is summarised in Table 6.3. The actual effluent standards to be adopted in the discharge licence will be further examined at detailed design stage, The scenario of adopting CEPT removal rate of 35% will also be assessed in the Chapter 7 of this report as a sensitivity test on water quality impact.

By the end of 2002 when the sewage treatment plant is commissioned, only part of the Cyber Port Development will be completed. The development population will only include residential population of 746 and working population of 5390. The estimated daily effluent flow will be 600 m^3/d at the end of 2002. A package plant will be provided at the SSDS drop shaft site to treat the sewage from the new development. The sewage from Baguio Villa and Kong Sin Wan Village will continue to discharge via the existing systems. The package plant will be decommissioned when the new preliminary treatment works, CEPT works and the submarine outfall are commissioned by the end of 2002. Effluent standards for the package plant will be as given in the Table 10a of the *Technical Memorandum: Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters,* for the inshore waters of the Western Buffer Water Control Zone. The effluent standards for the key parameters concerned are:

- BOD: 20 mg/l
- SS: 30 mg/l
- Total nitrogen: 80 mg/l
- E coli: 1000 count/100 ml

The effluent will be discharged via the existing seawall outfall.

Table 6.3 Effluent Quality for the CEPT Works

Parameter	Concentration
SS	125 mg/l
BOD	125 mg/l
NH3-N	25 mg/l
E coli	1.00E+04 counts/100ml

6.3 Proposed Sewage Treatment Processes

The proposed Telegraph Bay STW would comprise preliminary treatment, chemically enhanced primary treatment and disinfection processes. The preliminary treatment process would consist of coarse and fine screens, and a detritor for the removal of grit. It is intended that these facilities would form a permanent arrangement, which would eventually discharge the effluent into the SSDS Sewer.

However at this stage, it is not expected that the SSDS Scheme will be completed until late 2006. Therefore, temporary measures will be required until the SSDS Sewer is commissioned. These temporary measures would consist of a chemically enhanced primary treatment process, disinfection and then disposal through a temporary marine outfall. Sludge may be dewatered by centrifuges and the dewatered sludge will then be tankered off-site for disposal. In view of the relatively short operation life of the STW, it may be worthwhile to consider tankering the thickened sludge to a nearby STW. This arrangement would greatly simplify the STW operation and minimise the possible odour impact to the residential and commercial developments in the close vicinity. Preliminary information indicates that a suitable STW will not be available in the vicinity to take the sludge from the proposed Telegraph Bay STW. Alternative arrangement for disposal of sludge will be explored in detailed design of the Telegraph Bay STW. The thickened sludge volumes are estimated to be 8 to 32 m3/d based on 3% dry solids. The proposed treatment processes are described in more detail below.

Data sheets containing the preliminary design data for the principal treatment processes are contained in Appendix 6.2.

6.3.1 Screens

It is proposed that 2 mechanically raked screens (1 no. duty and 1 no. standby) with a clear bar openings of 50mm would be provided in the inlet channel. Mechanically raked fine screen (1 no. duty and 1 no. standby) would be provided. The fine screens would have a clear bar spacing of 6mm. Screenings would be passed through a screenings washing and compacting device prior to discharge into bags for subsequent disposal.

6.3.2 Grit Removal

It is proposed that two detritors (1 no. duty and 1 no. standby each of 0.32 m^3/s capacity) will be provided. These would remove grit particles (2.65 SG) of 0.2mm diameter and above. An alternative stirred-type of grit removal system (vortex type) may be considered in the detailed design stage because it requires significantly less space. This is particularly important at Telegraph Bay because of the need for complete cover to control odour.

6.3.3 Flow Measurement

A Parshall flume would be provided at the outlet from the preliminary works. This would control the depth of flow through the screens and grit chambers and provide flow measurement for process control. As a temporary measure, flows would then be pumped to the chemically enhanced primary treatment works for treatment before being discharged through the marine outfall.

6.3.4 Chemically Enhanced Primary Sedimentation (Temporary)

The temporary chemically enhanced primary treatment process would comprise coagulation, flocculation, and sedimentation. Two duty and one standby primary tanks would be required, each of dimensions 5m wide, 20m long and 4m deep. These would operate with a peak surface overflow rate of 99 m3/m2/d and a retention time of 3.38 hours under dry weather flow conditions. The exact size of the tanks will be determined in detailed design of the STW. Coagulation and flocculation would take place within the distribution channels of the primary tanks. The coagulant chemical would be alum (aluminium sulphate) if a UV facility is used for effluent disinfection.

Chain and flight scrapers would be used for sludge removal. These are an efficient form of sludge removal, which would allow the tanks to be more easily covered than, for example, travelling bridge scrapers.

In view of the need for complete cover for odour control, it may be worthwhile to consider more compact processes such as lamella clarifiers. However, the full-scale performance and O&M requirements must be fully addressed.

6.3.5 Disinfection (Temporary)

A UV disinfection facility would be installed to disinfect the effluent from the STW and reduce the bacteria count to an acceptable level. Owing to the constrained nature of the site, a medium pressure high intensity system would be required since this offers significant space savings compared to low pressure mercury lamps.

However, there are other methods of disinfection and should be further considered and evaluated at the later deign stages of this Scheme. If UV disinfection is used, then alum or other aluminium salts should be considered as the coagulant. Iron, either as a solid or in solution, will absorb radiation and hence reduce the UV disinfection efficiency.

6.3.6 Dewatering (Temporary)

Sludge dewatering may be carried out using horizontal decanter centrifuges. Dewatered sludge will then be stored on site before being collected for disposal at a landfill site.

6.3.7 Odour Control

All process units would be covered and the STW would be enclosed within a building. The pump sump, channels, screens and grit removal units would require removable lightweight lids. The ventilated flows would then be conveyed to an odour removal system to reduce odour levels to an acceptable level. The selection of the odour removal system should be undertaken during the detailed design stage and the temporary nature of the CEPT plant should be duly considered.

6.3.8 Preliminary Layout

The location of the sewage treatment works is shown in Figure 2.3. The site area for the preliminary treatment plant and the CEPT and disinfection plants is about 35m by 95m. A separate service building will be of the area of 350m^2. The SSDS drop shaft site, which will also be used for the temporary package treatment plant, will be of the area of 900m^2. The site area is considered sufficient for the sewage treatment facilities.